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AUTOMATIC CONTROLS FOR HONEY EXTRACTORS 1/

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Honey is extracted from the comb by centrifugal forces produced during rotation of the basket of a honey extractor. Two types of extractors are manufactured and used by commercial beekeepers. One type has the combs' faces parallel to the radii and is known as the radial extractor. The other extractor has the combs perpendicular to the radii and is called a reversible-basket or tangential type extractor. They are manufactured with manual controls to change the speed or to reverse the direction of rotation of the combs. These controls require an operator's attention during the extracting cycle. The Agricultural Engineering Research Division has developed automatic controls for these extractors that eliminate the operator's attention during the cycle. This paper presents the principles and construction of these automatic controls. As the controls on both machines operate differently the automatic units will be discussed separately.

RADIAL EXTRACTOR CONTROL

To extract the combs in a radial extractor the speed of the centrifuge is increased in 3 to 4 steps from 100 to 300 rpm to prevent comb failure and to remove all the honey. The machine is run at each speed from 2 to 10 minutes depending on the viscosity of the honey. In normal operation the operator performs other duties between speed changes; as a result, the time elapsed between settings varies according to the operator's estimate of time. His estimate may result in the machine running at one speed longer than necessary or, if he increases the speed too quickly, may cause the combs to break. An automatic unit properly timed will eliminate this trouble and will permit the operator to do other work. (Figures 1 and 2.)

1/ Cooperative investigations of the Agricultural Engineering Research and Entomology Research Divisions, Agricultural Research Service, USDA, and the Arizona and Wisconsin Agricultural Experiment Stations.

2/ Located at the Arizona Agricultural Experiment Station, Tucson, Arizona.

The unit developed by the Agricultural Engineering Research Division consists of a geared series motor, relays, switches, a time clock and a multi-tap transformer. The conventional friction-plate drive is removed and the geared motor is connected directly to the reel shaft. The motor is rated at approximately 1/2 hp at 300 to 400 rpm. If the output speed of the motor is more than 400 rpm the reel can be belt driven to permit full speed on motor with reel at 300 rpm. A series or universal motor is used because its speed varies with load and voltage and operates directly off 115 volts a.c.3/. The time clock used is a synchronous timing motor that makes one revolution every 20 minutes. The dial is made with machine-screw holes spaced so there is one hole every minute near the circumference and with a notch on the periphery for the clock switch so the clock will always stop at the same position. The microswitch is placed so the clock dial holds it closed except at the detent position. The clock pins rotate a spider wheel which is attached to a rotary switch. The rotary-switch contacts break before a change is made so only one circuit is closed at one time. As 60° is the maximum movement per actuation the switch has 10 contacts and rotates only 1/2 revolution per cycle. Each switch contact actuates a relay that connects a transformer tap to the motor for a selected voltage. The transformer is rated at 15 amp. and has 4 adjustable taps, one for each speed. Figure 3 shows the wiring diagram and Table 1 lists parts required for automatic unit.

Table 1. Speed Control Parts List for Radial Extractor.

No. Req.	Description	Use
1	Synchronous motor 20 minutes 1 rev.	
2	Toggle switches	Main and cutout for clock
1	Push-button switch	
1	Spring-lever microswitch 5-amp. rating	Clock
1	10-position rotary switch 10 amp. (break before make)	
4	Relays, 10-amp. capacity	
1	20-amp. fuse and holder	Main line
2	10-amp. fuses and holders	Transformer protector
2	Outlet plugs	
1	Variable transformer 15 amp. (modified for 4 adjustable contacts)	
1	Clock dial and spider designed to operate rotary switch	

3/ A typical motor would be an electric drill motor of 1/2"-5/8" capacity.

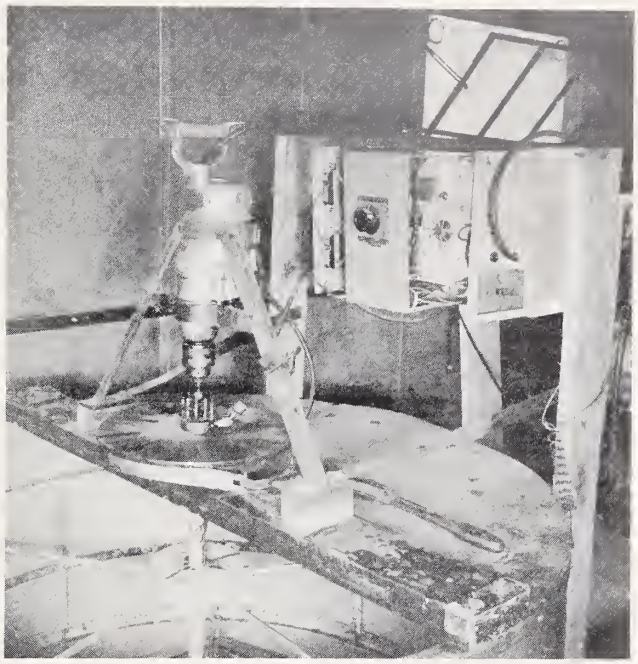


Figure 1. Automatic unit installed on a radial extractor.

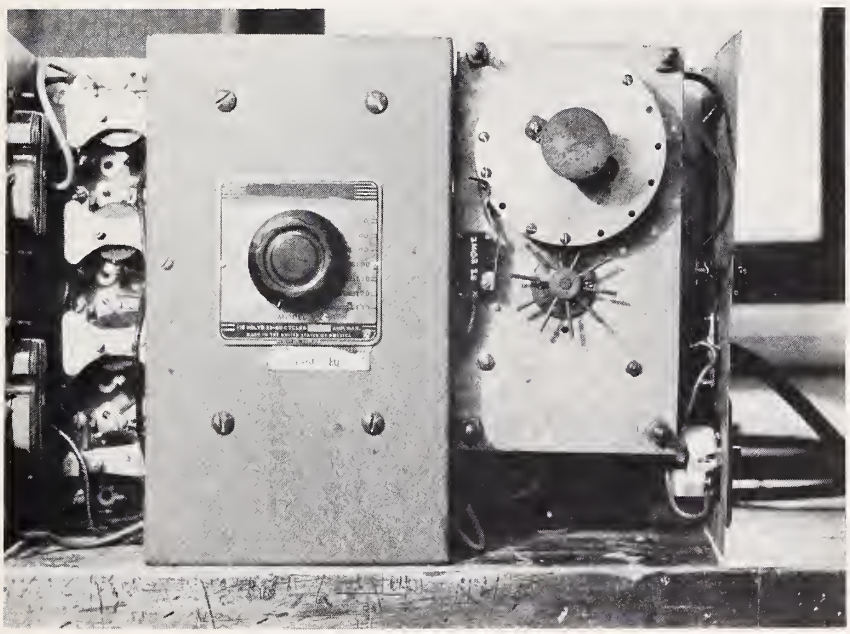
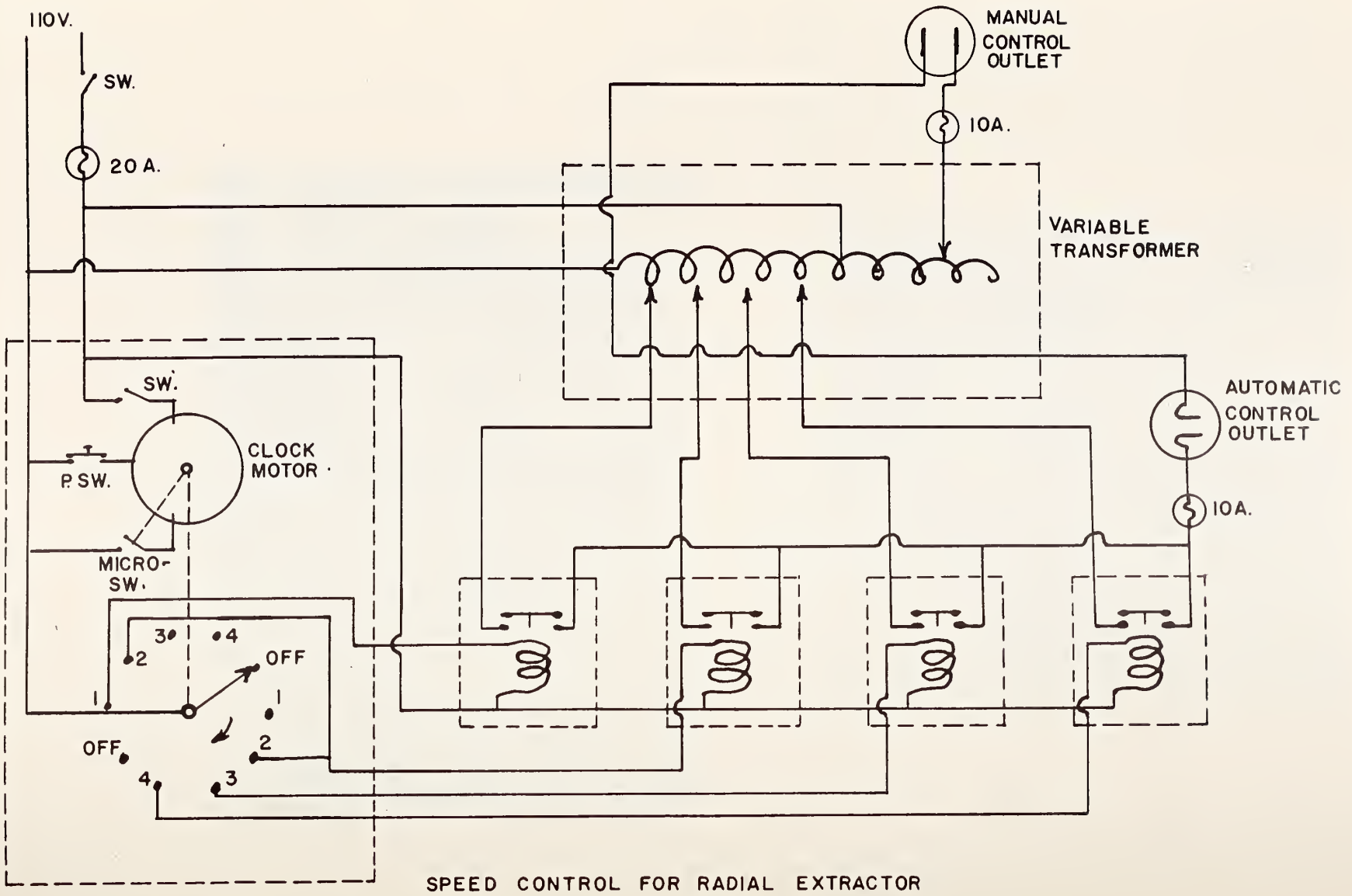


Figure 2. Closeup of automatic unit showing relays, transformer, and clock.



SPEED CONTROL FOR RADIAL EXTRACTOR

Figure 3.

A momentary holding of the push button starts the clock on its cycle and the rest is automatic. The common settings used on the unit at Madison, Wisconsin, are 40 volts for 4 minutes and 50, 65 and 80 volts for 2-minute intervals each. The time at a speed and the speed can be changed quickly to cope with varying honey conditions (Figure 2).

REVERSIBLE-BASKET EXTRACTOR CONTROL

The reversible-basket-type extractor is reversed 180° by a hand-operated brake 2 to 4 times during a 1- to 2-minute cycle. The number of reversals depends on the operator's procedure as to whether or not he extracts one side completely before reversing baskets. The last reversal is just prior to stopping to loosen the combs from the sides of the baskets to facilitate removal. The time interval between reversals is so short that the operator has little time to do other jobs. The automatic unit frees the operator for other duties during the extracting cycle. (Figures 4 and 5.)

The automatic unit for this extractor consists of a timing mechanism, switches and solenoids (Table 2). A push-button switch closes a latching relay that connects the power line to the extractor motor and the clock motor. The clock motor is a synchronous timing motor which makes 1 or 1/2 revolution per minute. The maximum time required depends on the honey condition for location. The clock dial is made for two rows of pins as in Figure 6. Outer-row pin closes the reversing switch and a leaf spring holds the switch in that position until a pin in the inner row pushes the spring down away from the switch lever. One microswitch operates on the edge of the dial to stop the clock when it returns to the starting position. A pin projecting from the dial strikes a switch that stops the extractor motor and actuates the stopping solenoid. The reversing switch is wired to the reversing solenoid and a positioning switch under the reel in the same manner as a two-way light circuit (Figure 7). To get connection to the switch under the reel the extractor shaft must have a 1/4" or 5/16" hole in the center from top of shaft to below the top reel. Slip rings are mounted on top of the shaft to transmit power to the positioning switch. A 180° band is welded to a basket to actuate the positioning switch. The two solenoids (reversing and brake) are mounted opposite each other and are fastened to a modified brake handle. The minimum rating for the solenoids is 10-pound pull at 1-1/4" stroke. Because the solenoids are limited to length of stroke it is necessary to install adjustments on each brake band to maintain proper operation. This automatic unit can be used with the conventional friction drive, but with a geared motor a compact belt drive can be used to eliminate a source of trouble and contamination.

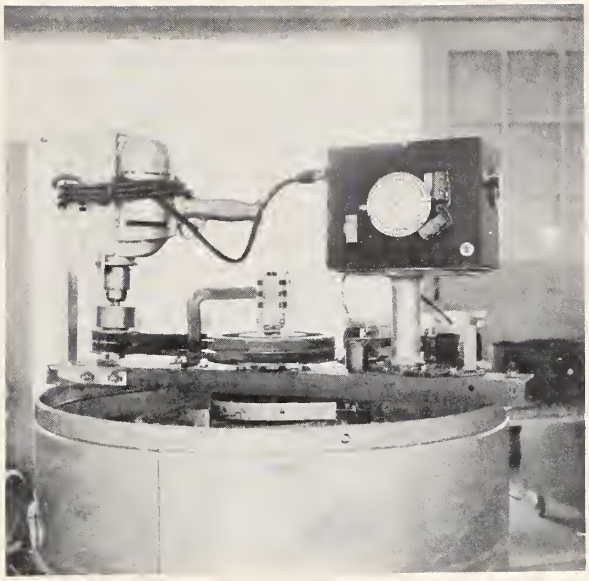


Figure 4. Installation of automatic unit for tangential extractor using a drill motor.

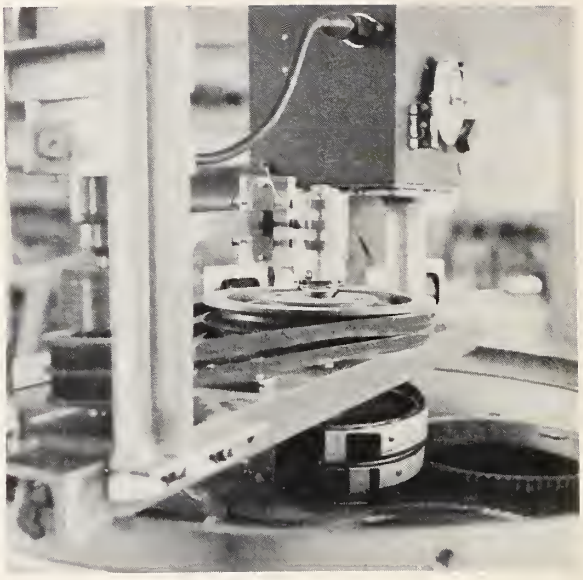


Figure 5. Closeup view of slip ring assembly.

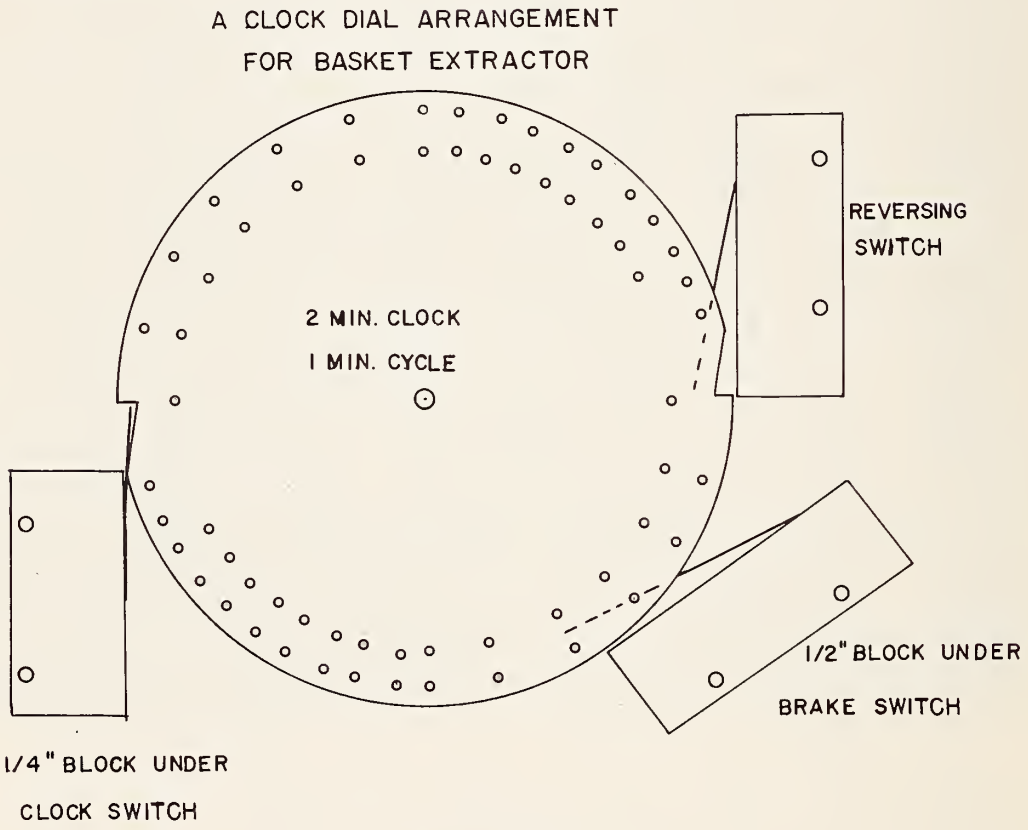


Figure 6.

REVERSIBLE-BASKET EXTRACTOR CONTROL

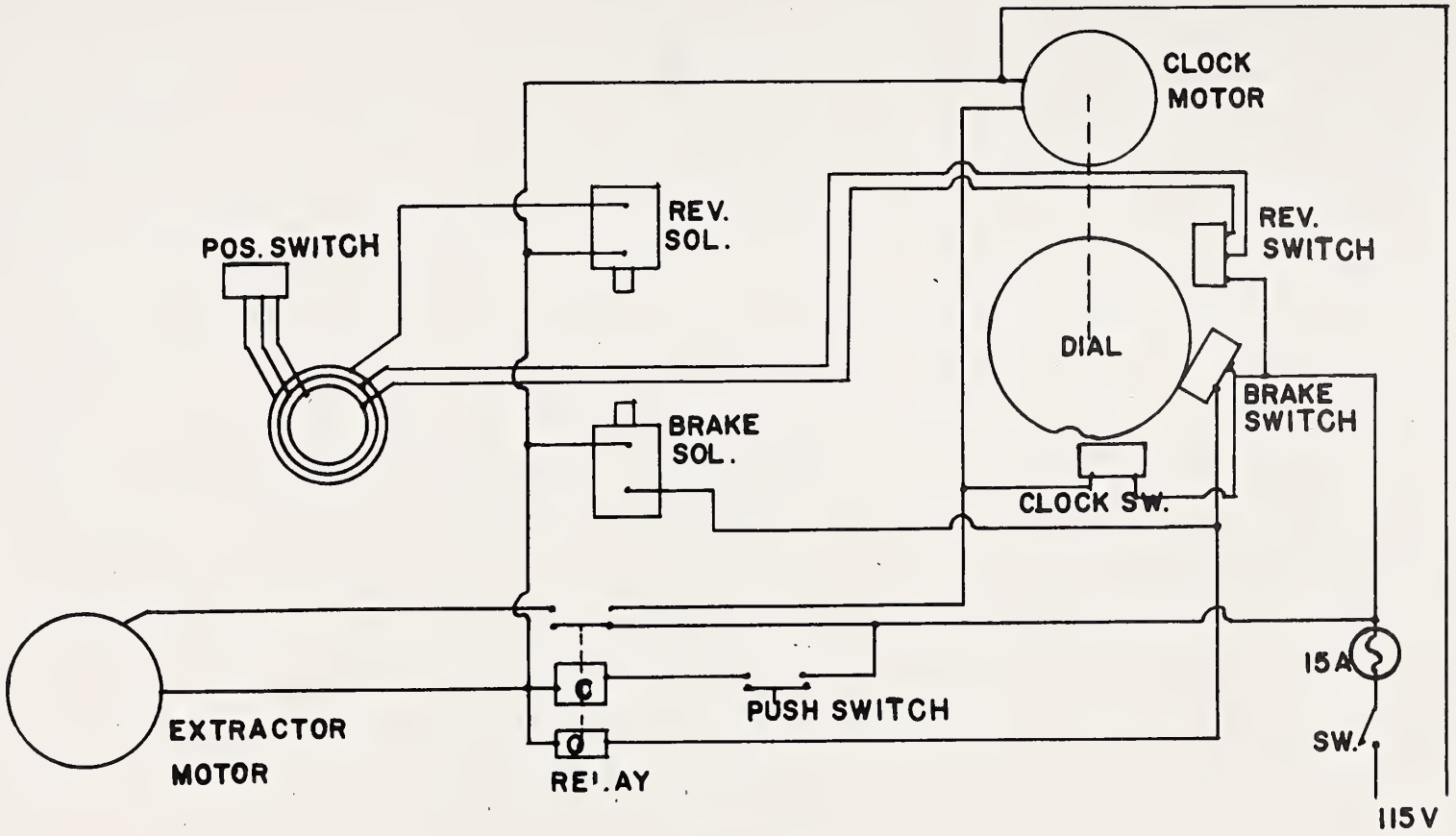


Figure 7.

Table 2. Automatic Control Parts List for Reversible-Basket Extractor.

No. Req.	Description	Use
2	Solenoids, 10-lb. pull at 1-3/8" stroke	Brake and reverse solenoid
1	Synchronous motor 1, 2 or 3 minutes for 1 rev.	
2	Spring-lever snap-action switches 10-amp. rating	Brake and reverse switch
1	Spring-lever snap-action switch 5-amp. rating	Clock switch
1	Sealed lever roller snap-action switch 10 amp.	Positioning switch
1	Toggle switch	On and off
1	Fuse holder and 15A fuse	
1	Push-button switch	
1	Latching relay 10-amp. contact rating	
3	Slip rings and brushes	
1	Dial designed to operate switches	

The placement of combs in the extractor, the pushing of a button, and the removal of the combs after extracting are the functions performed by the operator when an automatic unit is installed. Besides the saving of labor an automatic extractor may reduce the comb breakage and length of the extracting cycle, for once the time for the cycle has been determined and placed upon the clock dial, all extractions will be performed efficiently and completely. One cycle setting can be used during an extraction period as the honey will vary only slightly during that time. Changes in cycle may be needed at different extracting periods due to ambient temperature and/or to a different honey source. The cycle setting can be accomplished in less than a minute; and, when experienced, the operator can determine the cycle by a single run or may be able to predetermine it.

Agriculture-Washington